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This publication replaces previous descriptions of "Complex Operations Interpretive Routine 2," program H1-22.1. Explanations have been clarified and program references changed to their current designations.

FUNCTION

"Complex Operations Interpretive Routine 2" enables the user to interpret and execute instructions with B, A, S, D, M, H, and C orders as if they were floating point complex operation instructions referring to a two word floating point abstract accumulator. Also, it permits address modification of instructions and tests for the final address without leaving the floating point complex operation mode of programming. It allows for reading in or printing out floating point complex data. Conjugate, transpose, and transfer instructions are provided.

INPUT

Floating Point Interpretive System 1, program H1-24.0, and its input-output package (Data Input 7, program J2-11.6, and Data Output 7, program J3-12.6) are assumed to be in memory, beginning in locations 4000 and 5000 respectively.

OUTPUT

Program H1-22.1 may be used to print out the real and imaginary portions of the complex number. The imaginary portion of the number will be preceded by a "j".

COMPLEX OPERATIONS INTERPRETIVE ROUTINE 2

CALLING SEQUENCE

<u>Location</u>	<u>Order</u>	<u>Address</u>
XXXX	R	Lo
XXXX + 1	U	Lo
XXXX + 2	1st complex instruction	
XXXX + 3	2nd complex instruction	
XXXX + 4	etc.	
.	.	
.	.	
XXXX + n	XE	0000 Exit Instruction
XXXX + (n + 1)	1st fixed point instruction	

STORAGE

256 locations (4 tracks) are required in memory for storage of instructions and constants. 4 locations of temporary storage, namely track 63 sectors 10, 16, 52, and 60, are required. These locations are in addition to the ones used by program H1-24.0.

PROGRAM STOPS

<u>Location</u>	<u>Order</u>	<u>Address</u>	<u>Meaning and Remedy</u>
(Lo + 0162) ₁₀	Z	0848	Programmed stop. Depress START button to continue. Note: Programmed stops may be ignored by depressing BREAK POINT 8 button.

Error halts in program H1-24.0 also apply.

COMPLEX OPERATIONS INTERPRETIVE ROUTINE 2

ACCUMULATOR LOCATIONS

<u>Location</u>	<u>Contents of Location</u>
Lo + (0059) ₁₀	Real accumulator
Lo + (0033) ₁₀	Imaginary accumulator
Lo + (0227) ₁₀	Address accumulator

Lo is the initial location of program H1-22.1.

PROGRAMMING

After executing the R Lo and U Lo instructions (where Lo is the initial location of program H1-22.1), the computer will interpret and execute instructions as defined below. For simplicity, "m" is defined as a complex memory address, i.e., memory location m and m + 1, and m' is defined as a standard one word memory location. Complex operation instructions whose addresses are represented as T₁ T₂ S₁ S₂ do not refer to memory addresses. The T₁ T₂ S₁ S₂ indicates a track and sector absolute, i.e., increment by T₁ T₂ S₁ S₂.

ARITHMETIC INSTRUCTIONS

<u>Order</u>	<u>Address</u>	<u>Interpretation</u>
B	m	<u>Bring</u> The contents of memory location m replace the contents of the abstract accumulators.
A	m	<u>Add</u> The contents of the abstract accumulators plus the contents of m replace the contents of the abstract accumulators.
S	m	<u>Subtract</u> The contents of the abstract accumulators minus the contents of m replace the contents of the abstract accumulators.

COMPLEX OPERATIONS INTERPRETIVE ROUTINE 2

ARITHMETIC INSTRUCTIONS (Cont.)

<u>Order</u>	<u>Address</u>	<u>Interpretation</u>
D	m	<u>Divide</u> The contents of the abstract accumulators divided by the contents of m replace the contents of the abstract accumulators.
M	m	<u>Multiply</u> The contents of the abstract accumulators multiplied by the contents of m replace the contents of the abstract accumulators.
N	m	<u>Conjugate</u> The conjugate of the contents of the abstract accumulators replaces the contents of m. The contents of the abstract accumulators are unchanged.
H	m	<u>Hold</u> Place the contents of the abstract accumulators in m. The contents of the abstract accumulators are unchanged.
C	m	<u>Clear</u> Place the contents of the abstract accumulators in m and set the abstract accumulators to zero.
T	m	<u>Transpose</u> Place the contents of the real abstract accumulator in m + 1 and the contents of the imaginary abstract accumulator in m. The contents of the abstract accumulators are unchanged.

COMPLEX OPERATIONS INTERPRETIVE ROUTINE 2

LOGICAL OR TRANSFER INSTRUCTIONS

<u>Order</u>	<u>Address</u>	<u>Interpretation</u>
U	m'	<u>Unconditional Transfer</u> The next complex operation instruction to be interpreted is in memory location m'. This order does not constitute an exit from the complex operation subroutine.
800T	m'	<u>Conditional Transfer</u> The next complex operation instruction to be interpreted will be in memory location m' if the TRANSFER CONTROL button is down. Otherwise, the complex instruction immediately following the 800T m' instruction will be executed.

ADDRESS MODIFICATION

<u>Order</u>	<u>Address</u>	<u>Interpretation</u>
E	m'	<u>Enter</u> The address portion of memory location m' replaces the contents of the address accumulator.
XI	$T_1 T_2 S_1 S_2$	<u>Increment</u> The address accumulator is incremented by $T_1 T_2 S_1 S_2$.
Y	m'	<u>Store Address</u> The address portion of the address accumulator replaces the address portion of memory location m'.
XZ	$T_1 T_2 S_1 S_2$	<u>Zero Test and Jump</u> The instruction immediately following the instruction XZ $T_1 T_2 S_1 S_2$ is to be skipped if the address portion of the address accumulator is equal to $T_1 T_2 S_1 S_2$. If it is unequal the instruction following the XZ $T_1 T_2 S_1 S_2$ is executed.

COMPLEX OPERATIONS INTERPRETIVE ROUTINE 2

ADDRESS MODIFICATION (Cont.)

<u>Order</u>	<u>Address</u>	<u>Interpretation</u>
R	m'	<u>Set Return Address</u> The <u>location</u> of this instruction is increased by two and is stored in the address portion of memory location m'.
XE	0000	<u>Exit</u> Exit from the complex operation subroutine. Control is returned to the location following the XE0000 instruction.

INPUT-OUTPUT INSTRUCTIONS

<u>Order</u>	<u>Address</u>	<u>Interpretation</u>
XI	0000	<u>Input</u> Input complex data in the format of program H1-24.0 through the use of program J2-11.6. Real and imaginary parts of the complex number must be given in succession.
XP	0000	<u>Print</u> Print the contents of the abstract accumulators in floating point format with the imaginary part preceded by a j. The contents of the abstract accumulators are unchanged.

PROGRAMMED STOP INSTRUCTION

<u>Order</u>	<u>Address</u>	<u>Interpretation</u>
XZ	0000	<u>Stop</u> The computer will stop unless BREAK POINT 8 button is down.

COMPLEX OPERATIONS INTERPRETIVE ROUTINE 2

SPECIAL FEATURES

Attention is called to the fact that the following instructions are available:

X R 0000	Square Root
X N 0000	Natural Logarithm
X H 0000	Exponential (base e)
X C 0000	Cosine
X A 0000	Arc - Tangent
X S 0000	Sine.

The corresponding function subroutine must be in memory as specified in program H1-24.0 where Lo (of H1-24.0) must be track 40 sector 00. In every case, the contents of each abstract accumulator are replaced by the corresponding function after the execution of the instruction.

1
2
3

